



December 10, 2018

L-2018-225  
10 CFR 50.73

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D.C. 20555

Re: St. Lucie Unit 2  
Docket No. 50-389  
Reportable Event: 2018-002-00  
Date of Event: October 12, 2018  
Automatic Reactor Trip Due to a Breaker Failure on the 2A1 6.9kV Bus

The attached Licensee Event Report 2018-002 is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Respectfully,

A handwritten signature in dark ink, appearing to read 'Dan DeBoer', is written over a horizontal line.

Daniel DeBoer  
Site Director  
St. Lucie Plant

DD/rcs

Attachment

cc: St. Lucie NRC Senior Resident Inspector  
St. Lucie NRC Program Manager



## LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollections.Resource@nrc.gov](mailto:Infocollections.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

## 1. FACILITY NAME

St. Lucie Unit 2

## 2. DOCKET NUMBER

05000389

## 3. PAGE

1 OF 4

## 4. TITLE

Automatic Reactor Trip Due to a Breaker Failure on the 2A1 6.9kV Bus

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	12	2018	2018	002	00	12	10	2018	n/a	05000
									n/a	05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)			
1	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
100%	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(i)
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)
		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER	Specify in Abstract below or in NRC Form 366A

## 12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT

Richard Sciscente, Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(772) 467-7156

## 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO ICES	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO ICES
B	EA	BKR	S345	Y					

## 14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

## 15. EXPECTED SUBMISSION DATE

MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 12, 2018 at 1353 EDT with St. Lucie Unit 2 in Mode 1 at 100% Reactor power, an unplanned automatic Reactor trip occurred due to a failure of a supply breaker to the non-safety related 2A1 6.9kv bus during a transfer of the bus power supply from the 2A Auxiliary Transformer to the 2A Startup Transformer. The breaker failure caused a fire in the cubicle that was extinguished by onsite personnel.

The initial breaker problem developed after it was placed in service. However, there was no viable option to unload the breaker before opening. A team was formed to determine the options for resolving the condition. The option chosen was to use normal procedures with contingencies in place. The failure occurred as the damaged breaker was removed from service. The fault inside the breaker was the result of a ruptured SF6 gas vessel due to an inadequate design.

The failed breaker has been removed from service, and similar breakers susceptible to interrupter vessel failures are being evaluated for replacement. Additionally, action plans are being developed that will allow similar breakers to be unloaded in the event of future interrupter vessel failures.

Following the uncomplicated trip, the plant was maintained in Mode 3. Therefore, this event had no safety significance.



**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
St. Lucie Unit 2	05000389	2018	- 002	- 00

**NARRATIVE**Description

On October 12, 2018 at 1353 EDT with St. Lucie Unit 2 in Mode 1 at 100% Reactor power, an unplanned automatic Reactor trip occurred due to a fault on the non-safety 2A1 6.9kv bus [EA] during a transfer of the bus power supply from the 2A Auxiliary Transformer to the 2A Startup Transformer. The bus fault caused a fire in the cubicle [EA:BKR] that was extinguished by onsite personnel.

The Reactor trip was uncomplicated. Following the Reactor trip, both Steam Generators were supplied by the 2B Main Feedwater Pump [SJ]. All Reactor Control Element Assemblies [AA] fully inserted into the core. Decay heat removal was accomplished through forced circulation using two Reactor Coolant Pumps and with Main Feedwater and Steam Bypass Control Systems maintaining plant conditions in Mode 3.

Prior to the event on October 9, 2018, Operations identified that a Sulfur Hexafluoride (SF6) gas indicating light was not lit on the feeder breaker, 2-30101, from the 2A Unit Auxiliary Transformer to the 2A1 6.9kV bus. This light provides indication of normal SF6 gas pressure to quench the arcs from breaker operation.

On October 11, 2018, Operations and Electrical Maintenance performed a breaker cubicle inspection that identified remnants of a broken SF6 interrupter vessel under the 2-30101 breaker. The 2A1 6.9kV bus supplies power to the 'A' Main Feedwater Pump and two of four Reactor Coolant Pumps. The degraded interrupter vessel and the potential consequences of breaker operation without sufficient SF6 quench gas pressure prompted the Station to develop and analyze immediate actions. In the event of a plant trip, a fast dead bus transfer would have been automatically initiated resulting in the breaker 2-30101 opening under full load. With insufficient SF6 gas pressure within the interrupter vessel, the automatic opening of the breaker may have resulted in an electrical fault. A technical decision-making team was formed to determine the best options for resolving the identified condition.

The selected option was to perform a manual transfer of the 2A1 6.9kV bus from the 2A Auxiliary Transformer to the 2A Startup Transformer. The transfer would be performed using normal operating procedures, and the Startup Transformer feeder breaker would be synchronized and closed prior to opening the Auxiliary Transformer feeder breaker. The intent was to unload the Auxiliary Transformer feeder breaker to the maximum extent possible before opening the breaker. As such, the risk of an electrical fault would be minimized. This option recognized that the loss of the 2A1 6.9kV bus, a Reactor trip and an electrical fault could still result, and appropriate contingency actions were anticipated and planned.

Cause of the Event

The fault was caused by a breaker with an inadequate interrupter design that is susceptible to interrupter vessel failures. The design of the Yaskawa interrupter incorporates the support of bearings and other internal mechanical elements into the vessel. This results in additional mechanical loading to the vessel and therefore susceptibility to vessel damage.

The Yaskawa interrupter design imparts both structural and mechanical loads to its SF6 pressure vessel. The design function of the vessel is therefore not solely to provide SF6 gas boundary, but to also support various dynamic mechanical loads including support of the operator shaft bearings. The operator shaft bearings provide the counterforce to the breaker operator to open and close the movable interrupter contacts. The stresses of breaker operation are imparted to the vessel via the operator shaft bearings.



**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
St. Lucie Unit 2	05000389	2018	- 002	- 00

**NARRATIVE**

The 2A1 and 2B1 6.9kV buses supply power to the Reactor Coolant Pumps that may not be de-energized while the Reactor is critical. These buses may be fed from an Auxiliary Transformer or Startup Transformer; however, there are currently no options to completely de-energize their loaded feeder breaker prior to opening. In total between Units 1 and 2, there are eight non-safety related 6.9kV bus feeder breakers that are susceptible to interrupter vessel failures and that must be able to open while loaded.

**Analysis of the Event**

This Reactor trip event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as an actuation of the Reactor Protection System (RPS). This event had no significant safety consequence since the RPS successfully performed its intended safety function upon opening the trip circuit breakers.

The damaged breaker was identified by Operators performing scheduled checks of the SF6 indicating lights.

Upon discovery and follow-up breaker cubicle inspection as discussed above, a technical decision-making team made the recommendation to perform a manual transfer of the non-safety related 2A1 6.9kV bus from the 2A Auxiliary Transformer to the 2A Startup Transformer in order to minimize the risk of an electrical fault.

**Safety Significance**

The plant is designed to allow transfers of bus power supplies between the auxiliary and startup transformers. Manual transfers are "live bus" initiated by Operators, and the automatic transfer that occurs with a turbine trip is a "fast dead bus transfer." The failure of a bus transfer at the time of reactor trip breaker opening is an analyzed condition, which results in two of the four reactor coolant pumps coasting down. Reference Unit 2 UFSAR Chapter 15.01.5.

All safety related systems functioned as designed. There were no safety system actuations other than RPS actuation as a result of the event. There were no complications and all systems responded to the loss of the non-safety related 2A1 6.9 bus as designed. The plant safety related buses are located in a different building and were unaffected by the electrical fault. Both safety related 4.16kv buses remained energized and powered from the switchyard during this event. Given the response of the plant and the plant design that can accommodate this anticipated operational occurrence, the health and safety of the public were not affected by this event.

**Corrective Actions**

Immediate actions taken included the restoration and testing of the 2A1 6.9kv switchgear to allow re-energization using the Startup Transformer feeder breaker. The corrective action listed below has been entered into the site corrective action program. Any changes to the action will be managed under the corrective action program.

1. When the switchgear is restored, replace the 2-30101 2A1 UAT feeder breaker (Model 8WYB-2-500-2000) with a breaker design that is not susceptible to interrupter vessel failures. This replacement shall coincide with the repair of the switchgear.
2. Replace the 7 remaining Unit 1 & 2 6.9kV feeder breakers with a breaker design that is not susceptible to similar interrupter vessel failures.
3. Additionally, action plans are being developed that will allow similar breakers to be unloaded in the event of future interrupter vessel failures.

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
St. Lucie Unit 2	05000389	2018	- 002	- 00

**NARRATIVE**Failed Components Identified

1) The 6.9kV Switchgear 2A1-1 Circuit Breaker, 2-30101, is a 6.9kV, 2000A, 500MVA rated 'Magnum' circuit breaker supplied by Square D / NLI, Model 8WYB2-500-2000.

2) The Square D / NLI Magnum breaker is a retrofit product designed to replace air circuit breakers used in St Lucie Plant's legacy Westinghouse DHP switchgear.

3) The Square D / NLI Magnum breaker incorporates a Yaskawa FIXED TYPE, OGR circuit breaker incorporated into a breaker assembly compatible with the DHP switchgear. The Yaskawa OGR circuit breaker uses SF6 Gas rotary-arc quenching interrupter technology.

Similar Events

There were no previous arc flash events at St. Lucie Units 1 or 2 on the 4.16kv or 6.9kv buses.